

# NIF5002N

Preferred Device

## Self-Protected FET with Temperature and Current Limit

### 42 V, 2.0 A, Single N-Channel, SOT-223

HDPlus™ devices are an advanced series of power MOSFETs which utilize ON Semiconductors latest MOSFET technology process to achieve the lowest possible on-resistance per silicon area while incorporating smart features. Integrated thermal and current limits work together to provide short circuit protection. The devices feature an integrated Drain-to-Gate Clamp that enables them to withstand high energy in the avalanche mode. The Clamp also provides additional safety margin against unexpected voltage transients. Electrostatic Discharge (ESD) protection is provided by an integrated Gate-to-Source Clamp.

#### Features

- Current Limitation
- Thermal Shutdown with Automatic Restart
- Short Circuit Protection
- $I_{DSS}$  Specified at Elevated Temperature
- Avalanche Energy Specified
- Slew Rate Control for Low Noise Switching
- Overvoltage Clamped Protection

#### Applications

- Lighting
- Solenoids
- Small Motors

#### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

Rating	Symbol	Value	Unit
Drain-to-Source Voltage Internally Clamped	$V_{DSS}$	42	V
Drain-to-Gate Voltage Internally Clamped ( $R_G = 1.0\text{ M}\Omega$ )	$V_{DGR}$	42	V
Gate-to-Source Voltage	$V_{GS}$	$\pm 14$	V
Continuous Drain Current	$I_D$	Internally Limited	
Power Dissipation	@ $T_A = 25^\circ\text{C}$ (Note 1)	1.1	W
	@ $T_A = 25^\circ\text{C}$ (Note 2)	1.7	
	@ $T_T = 25^\circ\text{C}$ (Note 3)	8.9	
Operating Junction and Storage Temperature	$T_J, T_{stg}$	-55 to 150	$^\circ\text{C}$
Single Pulse Drain-to-Source Avalanche Energy ( $V_{DD} = 32\text{ V}, V_G = 5.0\text{ V}, I_{PK} = 1.0\text{ A}, L = 300\text{ mH}, R_{G(ext)} = 25\ \Omega$ )	$E_{AS}$	150	mJ

#### THERMAL RESISTANCE RATINGS

Rating	Symbol	Value	Unit
Junction-to-Ambient - Steady State (Note 1)	$R_{\theta JA}$	114	$^\circ\text{C/W}$
Junction-to-Ambient - Steady State (Note 2)	$R_{\theta JA}$	72	
Junction-to-Tab - Steady State (Note 3)	$R_{\theta JT}$	14	

1. Surface-mounted onto min pad FR4 PCB, (2 oz. Cu, 0.06" thick).
2. Surface-mounted onto 2" sq. FR4 board (1" sq., 1 oz. Cu, 0.06" thick).
3. Surface-mounted onto min pad FR4 PCB, (2 oz. Cu, 0.06" thick).

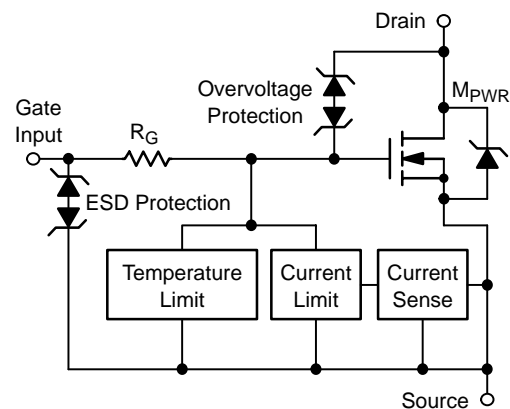


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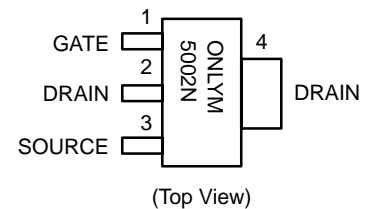
$V_{(BR)DSS}$ (Clamped)	$R_{DS(ON)}$ TYP	$I_D$ MAX
42 V	165 m $\Omega$ @ 10 V	2.0 A*

\*Max current limit value is dependent on input condition.



SOT-223  
CASE 318E  
Style 3

#### MARKING DIAGRAM



5002N = Specific Device Code  
L = Location Code  
YM = Year, Month

#### ORDERING INFORMATION

Device	Package	Shipping†
NIF5002NT1	SOT-223	1000/Tape & Reel
NIF5002NT3	SOT-223	4000/Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

Preferred devices are recommended choices for future use and best overall value.

# NIF5002N

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit	
<b>OFF CHARACTERISTICS</b>							
Drain-to-Source Breakdown Voltage (Note 4)	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 10 mA	T <sub>J</sub> = 25°C	42	46	55	V
			T <sub>J</sub> = 150°C	40	45	55	
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 32 V	T <sub>J</sub> = 25°C		0.25	4.0	μA
			T <sub>J</sub> = 150°C		1.1	20	
Gate Input Current	I <sub>GSSF</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = 5.0 V		50	100	μA	

## ON CHARACTERISTICS (Note 4)

Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 150 μA	1.3	1.8	2.2	V	
Gate Threshold Temperature Coefficient	V <sub>GS(th)</sub> /T <sub>J</sub>			4.0	6.0	-mV/°C	
Static Drain-to-Source On-Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 1.7 A	T <sub>J</sub> = 25°C		165	200	mΩ
			T <sub>J</sub> = 150°C		305	400	
		V <sub>GS</sub> = 5.0 V, I <sub>D</sub> = 1.7 A	T <sub>J</sub> = 25°C		195	230	
			T <sub>J</sub> = 150°C		360	460	
		V <sub>GS</sub> = 5.0 V, I <sub>D</sub> = 0.5 A	T <sub>J</sub> = 25°C		190	230	
			T <sub>J</sub> = 150°C		350	460	
Source-Drain Forward On Voltage	V <sub>SD</sub>	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 7.0 A		1.0		V	

## SWITCHING CHARACTERISTICS

Turn-on Time	t <sub>d(on)</sub>	V <sub>GS</sub> = 10 V, V <sub>DD</sub> = 12 V, I <sub>D</sub> = 2.5 A, R <sub>L</sub> = 4.7 Ω, (10% V <sub>in</sub> to 90% I <sub>D</sub> )		20	30	μs
Turn-off Time	t <sub>d(off)</sub>			65	100	
Slew Rate On	dV <sub>DS</sub> /dt <sub>on</sub>	R <sub>L</sub> = 4.7 Ω, V <sub>in</sub> = 0 to 10 V, V <sub>DD</sub> = 12 V, 70% to 50%		1.2		V/μs
Slew-Rate Off	dV <sub>DS</sub> /dt <sub>off</sub>	R <sub>L</sub> = 4.7 Ω, V <sub>in</sub> = 0 to 10 V, V <sub>DD</sub> = 12 V, 50% to 70%		0.5		

## SELF PROTECTION CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise noted) (Note 5)

Current Limit	I <sub>LIM</sub>	V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 5.0 V	T <sub>J</sub> = 25°C	3.1	4.7	6.3	A
			T <sub>J</sub> = 150°C	2.0	3.2	4.3	
		V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 10 V	T <sub>J</sub> = 25°C	3.8	5.7	7.6	
			T <sub>J</sub> = 150°C	2.8	4.3	5.7	
Temperature Limit (Turn-off)	T <sub>LIM(off)</sub>	V <sub>GS</sub> = 5.0 V	150	175	200	°C	
Temperature Limit (Circuit Reset)	T <sub>LIM(on)</sub>	V <sub>GS</sub> = 5.0 V	135	160	185		
Temperature Limit (Turn-off)	T <sub>LIM(off)</sub>	V <sub>GS</sub> = 10 V	150	165	185		
Temperature Limit (Circuit Reset)	T <sub>LIM(on)</sub>	V <sub>GS</sub> = 10 V	135	150	170		

## ESD ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise noted)

Electro-Static Discharge Capability	ESD	Human Body Model (HBM)	4000			V
		Machine Model (MM)	400			

4. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.

5. Fault conditions are viewed as beyond the normal operating range of the part.

TYPICAL PERFORMANCE CURVES

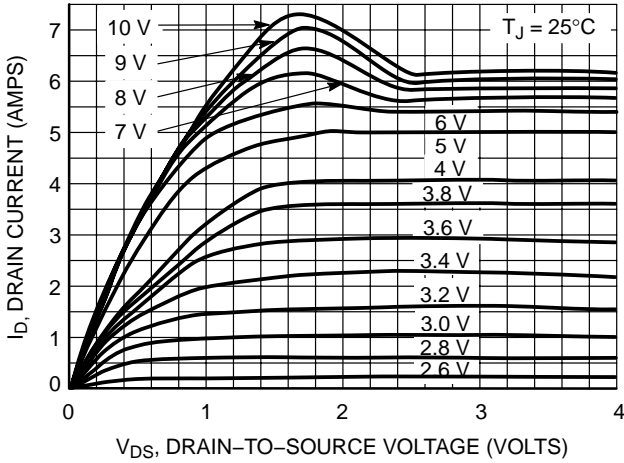


Figure 1. On-Region Characteristics

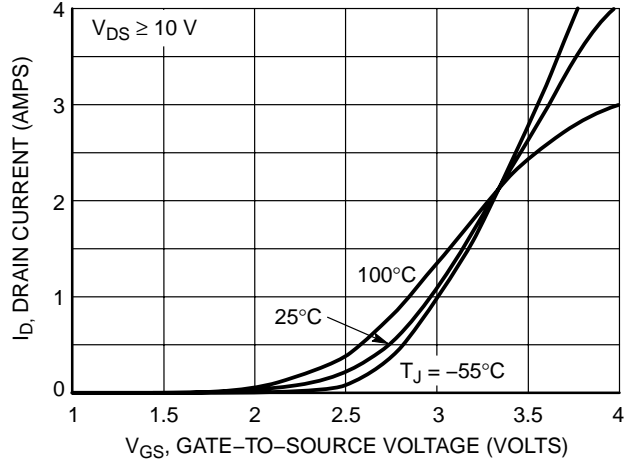


Figure 2. Transfer Characteristics

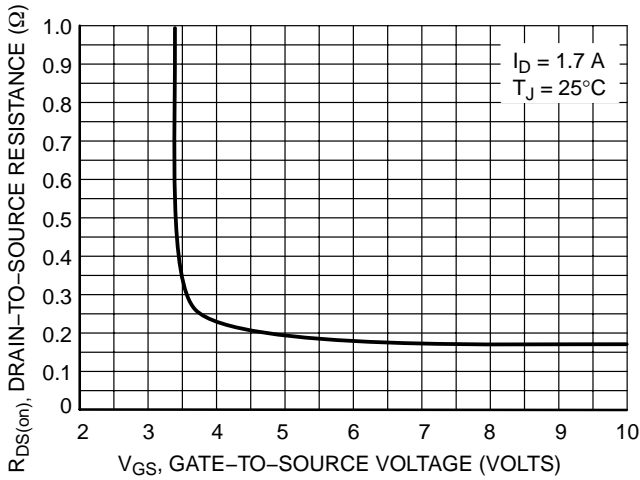


Figure 3. On-Resistance vs. Gate-to-Source Voltage

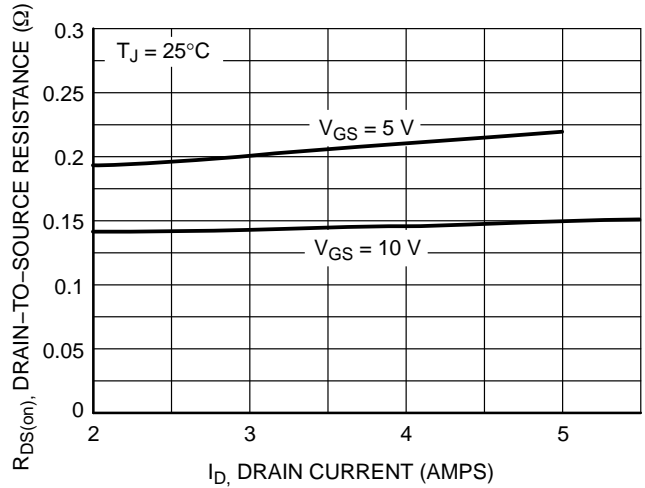


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

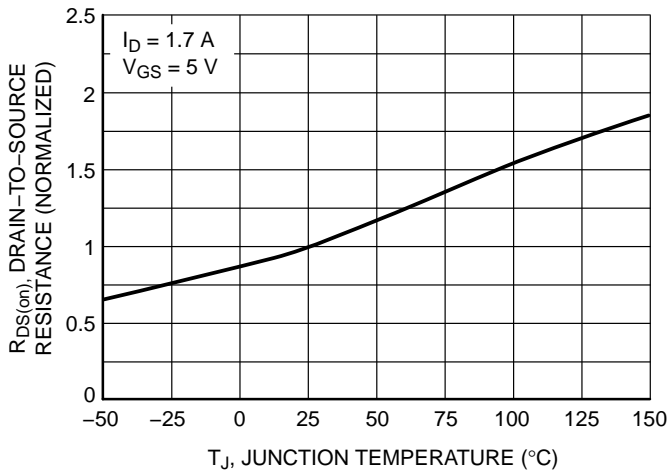


Figure 5. On-Resistance Variation with Temperature

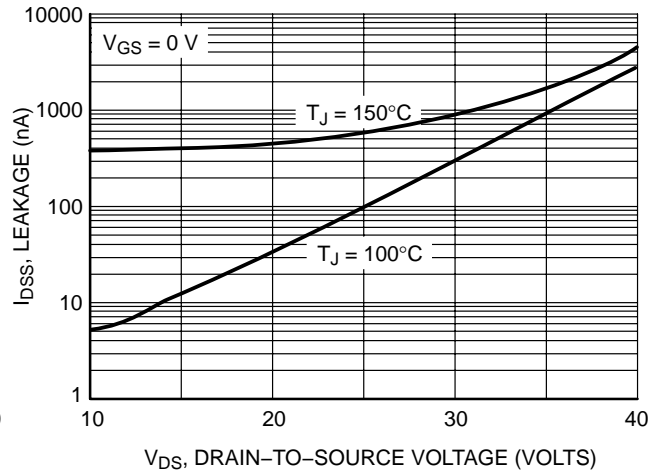


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL PERFORMANCE CURVES

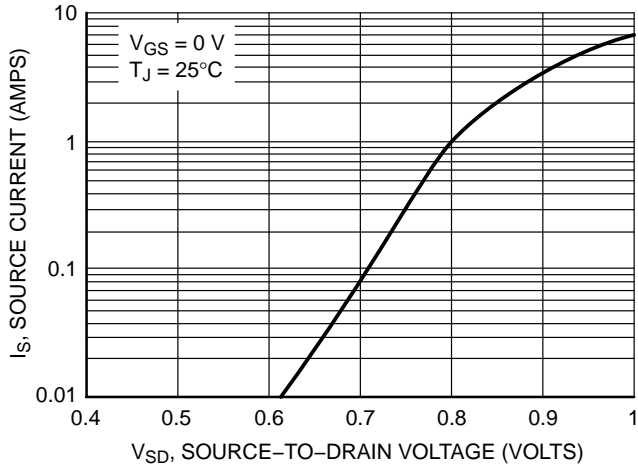


Figure 7. Diode Forward Voltage vs. Current

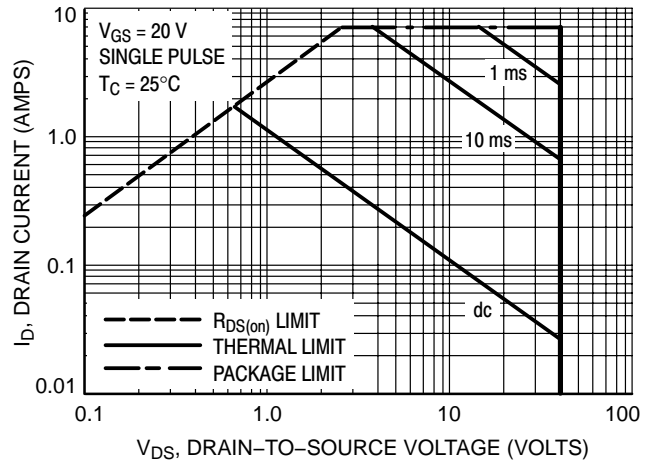


Figure 8. Maximum Rated Forward Biased Safe Operating Area

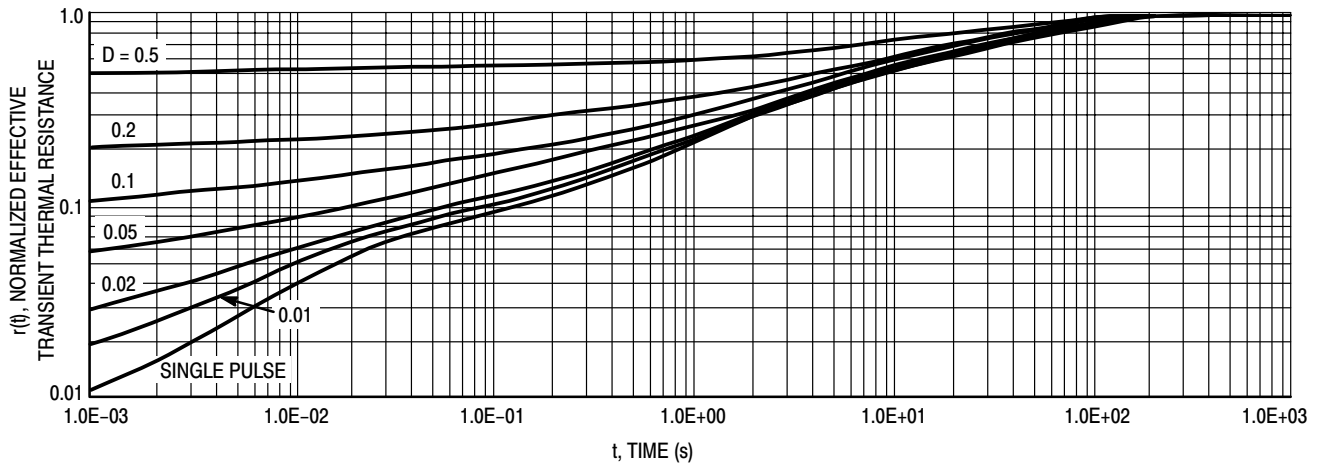
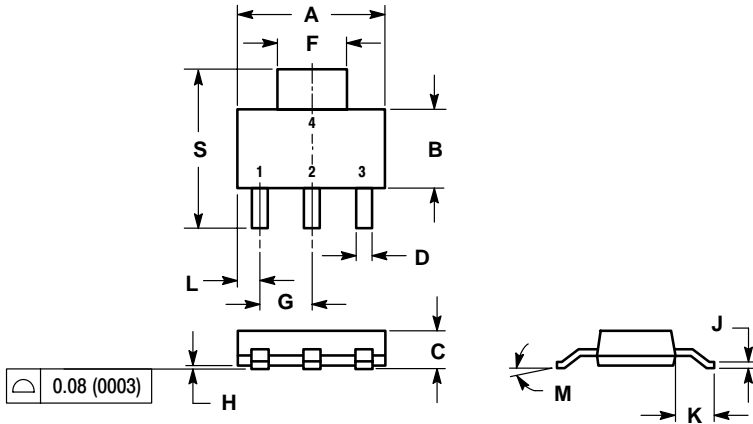


Figure 9. Thermal Response

# NIF5002N

## PACKAGE DIMENSIONS

SOT-223  
CASE 318E-04  
ISSUE K



- NOTES:  
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.249	0.263	6.30	6.70
B	0.130	0.145	3.30	3.70
C	0.060	0.068	1.50	1.75
D	0.024	0.035	0.60	0.89
F	0.115	0.126	2.90	3.20
G	0.087	0.094	2.20	2.40
H	0.0008	0.0040	0.020	0.100
J	0.009	0.014	0.24	0.35
K	0.060	0.078	1.50	2.00
L	0.033	0.041	0.85	1.05
M	0°	10°	0°	10°
S	0.264	0.287	6.70	7.30

- STYLE 3:  
PIN 1. GATE  
2. DRAIN  
3. SOURCE  
4. DRAIN

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